IN THE CLAIMS:

1. (Currently Amended) A vehicle collision avoidance system (apparatus) comprising

a circumferentially dual rotating pulsed infrared laser beam scanner, termed **CDR scanner,** which consisting of

a circumferentially rotating laser pulsed infrared emitter, which delivers IR laser beam to scan the objects circumferentially surrounding the host vehicle, and

an IR laser sensor, which circumferentially and synchronously rotates with said rotating laser pulsed emitter to receive the reflected first signal from the surrounding objects being scanned by said scanning IR laser beam.

a signal processing unit, consisting of

- an analog processing unit, termed APU and a digital processing unit, termed DPU. The APU is coupled to said CDR scanner for processing said first signal and generating its plurality of signals; while the DPU , **with its built in algorithm/software, introduced in the method of avoiding a vehicle collision carried in claim 7, 9,11,12,13,14 and 18,** couple to the APU for processing the plurality of signals after A/D converter and generates a braking signal; and
- an warning means or a braking unit

Said warning means to warn the driver of a threaten of collision requiring an immediate control action while said braking consisting of an electro-mechanical converter unit and a braking executing unit, which responsive to the braking signal from said signal-processing unit.

2. (Currently Amended) The vehicle collision avoidance system (apparatus) in claim 1, comprising a circumferentially rotating laser pulsed emitter within said CDR scanner, which **rotates around a vertical axis (vertical to the plane where the host vehicle locates) and horizontal axis (which is being parallel to the suppositional plane where said host vehicle rests)**

simultaneously at appropriate speed(s), and thus forming a dual rotating laser scanner. Referring to a shift able, four-dimension co-ordinate system, with a time variable sphere co-ordinate system, the position of said **CDR scanner** in the host vehicle is assumed to be the origin point while all objects surrounding the host vehicle locate at the points denoted by P (ρ, θ, α, t), where ρ is the relative distance between the **CDR scanner** of the host vehicle and the objects being scanned with predetermined appropriate range limited by the object detecting sensibility of said **CDR scanner,** θ is the horizontal angle with defined range between 0° and 360°, α is the vertical angle, that is, an angle respected to horizontal plane with a predetermined appropriate range, and t is the time during the operating of said vehicle collision avoidance system carried by said host vehicle.

3. (Currently Amended) The vehicle collision avoidance system of claim 1, wherein the circumferentially rotating pulsed infrared laser beam scanner apparatus is typically **operable to scan and detect an object from distance of 1.6m to 120m**, diverging in all directions radiated from the host vehicle, which is so typically set in order to meet the demanding from the real traffic environment, which contains objects with rather high relative speed.

4. (Currently Amended) The vehicle collision avoidance system of claim 1 and claim 2, wherein the circumferentially rotating pulsed infrared laser beam scanner apparatus **rotates in the horizontal plane at typically about 48 revolutions per second** and in the vertical plane wherein the typical rotation speed is such arrange that, **the time to swipe over the depression angle, which faces the scanning range in vertical direction, is about 125ms** (shown in Fig.2).

5. (Currently Amended) The vehicle collision avoidance system of claim 1, **further more comprising a set of specifications on the structure of the scanning pulsed infrared laser scanner and the manner it operates**, wherein the circumferentially rotating pulsed infrared laser beam scanner emits a laser beam having 28.45W peak power, an average power of 142mW, a wavelength between 1μm and 1.550μm excluding the region between 1.3μm and 1.4μm, and preferably between 1.450μm and 1.550μm, a 1.0ns to 1.25ns pulse

width, a 10Mhz to 110Mhz repetition rate, and a 0.002 radian emitting pulsed laser beam divergent angle.

6. (Canceled)

7. (Currently Amended) A method of avoiding a vehicle collision, comprising the constructing and using of a unit of signal processing, termed SPU, which consisting said APU and said DPU, incorporated with **a circumferentially dual rotating pulsed infrared laser beam scanner** that scans the objects circumferentially surrounding the host vehicle for processing first signal from the scanned object and generating its plurality of signals; while said DPU (with its built in algorithm/software) couples to the APU for processing the plurality of signals and generates a braking signal or warning signal. Said DPU determines the particular features based on said first signal originating from the scanned objects over the 360° plane in said shift able four-dimension sphere co-ordinate system; and based on the processing result that continuously provided by said USP, the host vehicle is thus able to avoid a collision with the objects in its surrounding field, through the braking of the host vehicle.

8. (Canceled)

9. (Currently Amended) The method of avoiding a vehicle collision of claim 7, further comprising such set of typical parameters predetermined for the system's construction and operating as below: Wherein the circumferentially rotating pulsed infrared laser beam scanner emits a laser beam having 28.45W peak power, an average power of 142mW, a wavelength between 1μm and 1.550μm excluding the region between 1.3μm and 1.4μm, and preferably between 1.450μm and 1.550μm, a 1.0ns to 1.25ns pulse width, a 10Mhz to 110Mhz repetition rate, and a 0.002 radian emitting pulsed laser beam divergent angle.

10. (Canceled)

11, (Currently Amended) The method of avoiding a vehicle collision in claim 7 further comprising

detecting of object elements

wherein said circumferential objects under detecting, upon obtaining signal of reflected pulsed infrared laser beam from the scanned objects, are divided and treated as a string of object elements by means of a signal processing unit. And such dividing is realized by exploiting the phenomenon that the absolute value of the changing rate of said relative distance becomes extremely large when the scanning beam reaches the edge of an object element. Wherein the said relative distance can be retrieved from the reflected signal during the scanning of said CDR scanner; and

an uniform relative speed assumption

which assuming that, within any single circular circumferential laser beam scanning for object detecting, the value of said relative velocities between any point within a same object element being detected by the laser scanning beam are all equal, and is further assumed to be equal to a value obtained at said critical point defined in the immediate following paragraph.

12. (Currently Amended) The method of avoiding a vehicle collision in claim 7 further comprising **a critical point** which is a particular point existing on the surface of an object element surrounding said host vehicle. Said critical point is so defined that at which point, according to the result of the laser beam scanning, an absolute value of the **third derivative** (not second derivative!) of the relative distance approaches zero, after comparing it with a pre-determined small value. The relative velocity is then accurately measured and determined with the reflected signal received at that very moment when the critical point is found. (This is attributed to the fact that at this moment, the rotation effect due to the shape of the object can be eliminated.)

13. (Currently Amended) The method of avoiding a vehicle collision in claim 7 further comprising determining **said relative distance, said relative velocity and said a relative angular velocity** of each object element belonging to the object surrounding said host vehicle;

14. (Currently Amended) The method of avoiding a vehicle collision in claim 7 further comprising determining a time to collision in which **the derivatives of both relative velocity and the relative angular velocity are**

obtained by the system hardware (such as said SPU described in claim 7), and since the computation for time to **collision** reflects the change of the speed in both vertical and horizontal directions, such a physics-mathematical model should able to obtain a much more accurate result.

15. (Canceled)

16. (Canceled)

17. (Canceled)

18. (Currently Amended) The method of avoiding a vehicle collision of claim 7, wherein determining **the time to collision consists of** both **vertical and horizontal two components – Time taken to get aligned with the vertical line, and time taken to get aligned with the horizontal line;** where the former is determined by using the horizontal parameters, including relative angle (referring to the direction that the host vehicle is heading toward at that moment of scanning), relative angular velocity and relative angular acceleration; while the later is determined by using the vertical parameters, including relative distance, relative velocity and relative acceleration. The step of determining **the former** is certainly necessary and is as important as determining **the later** - the component of vertical approaching, because it tells how quick object elements is coming toward the track that the host vehicle rests on, as well as in how long to reach.

(19, 20, 21 and 22 are all canceled)